A DECISION SUPPORT SYSTEM FOR PREVENTION AND TREATMENT OF PRESSURE ULCERS BASED ON AHCPR GUIDELINES

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We have developed a Pressure Ulcer Prevention and Management System to assist clinicians with patient-specific decision making. The system captures coded data about assessment, diagnosis and interventions using a point-and-click interface. Guideline-based knowledge is imbedded into the system, and is accessible in several ways: 1) via hypertext links from the data entry screens; 2) via explicit entry into an indexed version of the guideline; 3) via imbedded knowledge-based rules that critique the diagnosis and offer guidance for treatment; and 4) via explicit entry into interactive algorithms. The system has been implemented experimentally on one care unit at our hospital, where its impact will be assessed in comparison with a control unit. Preliminary usage data are provided. Issues with rendering guideline material useful for patient-specific decision support are discussed. In our setting, these issues had to do with a) incongruity with local standards; b) insufficient specificity; and 3) insufficient comprehensiveness. Issues of use and dissemination in the context of today's health care environment are also addressed.

INTRODUCTION

As part of a research project intended to provide problem-based knowledge to clinicians at the point of care, we have developed a system that supports the nurse's development of patient-specific, guideline-based treatment plans for patients who have pressure ulcers or are at risk for developing them. The system captures assessment data, diagnoses and interventions in coded form, using a point-and-click interface.

BACKGROUND

The prevalence of pressure ulcers is unacceptably high, cited as 11% of all hospitalized patients[1] to 23% of all nursing home patients[2]. As many as 54% of these patients are between the ages of 70 and 89[1]. Pressure ulcers are associated with a fourfold increase in risk of death among geriatric and nursing home patients[3]. The average cost of hospitalization of patients with pressure ulcers in one study was almost four times the cost for all other patients hospitalized in 1984[4]. One study showed that the cost of products used for treatment was 2.5 times greater than for prevention[5]. Thus the best approach remains preventive.

Educational programs that focus on the prevention of pressure ulcers have been shown to be effective. In one study, the incidence of pressure ulcers was reduced by two thirds[6]. Education is cited by many other authors as an appropriate strategy. Education, while effective, requires continuing monitoring and expenditure of resources.

GUIDELINES OF CARE

The Agency for Health Care Policy and Research has developed guidelines on Prediction and Prevention of Pressure Ulcers in Adults[7] and on Treatment of Pressure Ulcers[8]. They have been widely disseminated. However, it has been clearly demonstrated that there is a wide gap between disseminating guidelines and realizing changes in behavior as a result of the information disseminated[9]. The focus of this project is to provide multiple ways of accessing information that is relevant to the case at hand, thus providing clinically appropriate information at the "teachable moment." Not only is the care of a particular patient impacted at the time that care is rendered, but the clinician is more apt to

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internalize the knowledge used, precisely because it is provided in the context of a clinical problem to be solved[10].

The system we developed provides decision support in four distinct ways: 1) The data entry screens provide explicit cues as to the assessment data needed to make a diagnosis and form a treatment plan; 2) individual items on screen can be clicked on for a definition of the term and an explanation of the relevance of that term (in most cases, this information is taken directly from the AHCPR guidelines); 3) a critiquing system for diagnosis based on a variety of sources assists the user in determining whether the patient is at risk or not; and 4) an extended set of rules, taking into account assessment and diagnosis data, guides the user in developing a patient-specific treatment plan (see Figure 1).

The knowledge base and expert system modules are derived mainly from the AHCPR guidelines, and from other sources, such as local standards of care[11] and published texts[12,13]. The characteristics and features of the system are more fully described in Estey et al, these proceedings[14].

IMPLEMENTATION

The pressure ulcer prevention and management program was implemented experimentally in December 1995 on a 20-bed inpatient orthopedic/neurosurgery unit at the Massachusetts General Hospital. The staff includes 10 full-time and 12 part-time nurses. Of these 22 nurses, 13 remained enrolled in the study through completion of post-testing. Those who didn't enroll were part-time personnel, or permanent off-shift nurses who felt that the system was mostly intended to help primary nurses with assessment and treatment planning.

This unit had a heightened awareness of pressure ulcer assessment. The nurses routinely completed a pressure ulcer risk assessment (using the Braden Scale) for all patients on admission, and thereafter on a periodic basis. This manually completed form was kept in the patient's record for the duration of the hospitalization. During the experimental period, the automated decision support system replaced completion of the manual form for assessment, and in addition allowed nurses to create and print a patient-specific treatment plan.

The intent was to make the knowledge access system an integral part of the workflow for patients with a diagnosis of risk for pressure ulcer or actual pressure ulcer. Nurses participating in the experiment were expected to complete their skin assessments for all patients on the computer; for patients with a diagnosis of risk for pressure ulcer or actual pressure ulcer, they were expected to complete a care plan on the computer. After verifying the care plan, they could call for a patient-specific printout for the patient's record that was identical in format to the manual forms used. Compliance was variable, depending partly on the particular nurse user, and mostly on the intensity of the work load on any given day. A two-week spot check of admissions to the unit showed that the majority of patients admitted to the unit had a skin assessment recorded in the computer within 48 hours of admission

To date, all of the study subjects on the experimental care unit have entered real patient data at least once. Data for 113 patients have been entered so far by these 13 individuals over a 21 week period.

System Use

The number of user sessions to date is displayed in Table 1. A session is defined as any time a nurse user logs on, whether a care plan was completed or not (if a patient was found to be not at risk for pressure ulcer, a care plan pertaining to skin was not completed). Duration of sessions is reported in Table 2.

For the one hundred and thirteen patients on whom diagnoses were recorded, they were recorded as follows: 46 diagnoses of "No risk for pressure ulcer"; 70 diagnoses of "Risk for pressure ulcer"; and 5 diagnoses of "Alteration in Skin Integrity: Stage 2 pressure ulcer." The five patients who had diagnoses of actual pressure ulcers also had a concurrent diagnosis of "Risk for pressure ulcer". For three patients, a diagnosis of "No risk for pressure ulcer" was subsequently changed to "Risk for pressure ulcer."

EVALUATION

The system is being evaluated from several perspectives, including a) instructional adequacy, b) impact on clinicians' knowledge; c) impact on clinical decision-making; d) impact on processes of care; and

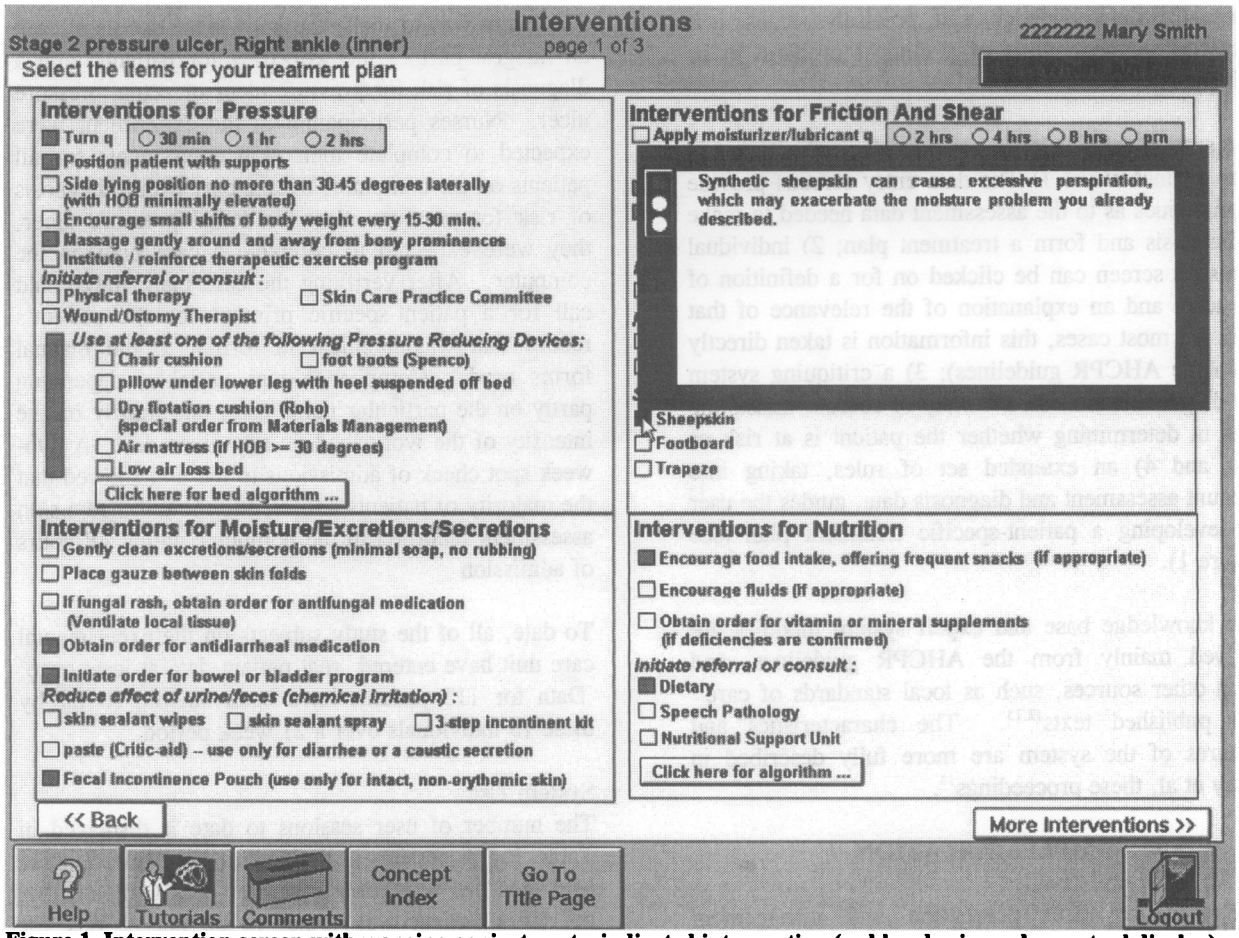

Figure 1 Intervention screen with warning against contraindicated intervention (red border is used on actual display)

Table 1. System usage to date

Number of Nurse Users	Total Number of complete & incomplete sessions	Average Number of sessions per user	Minimum Number of sessions	Maximum Number of sessions	Median Number of sessions
13	134	10	1	27	7

Table 2. Duration of sessions

Plan Completed	Total Minutes	Number of Sessions	Average Mins/session	Min	Max	Median
No	22	6	4	0	12	2
Yes	904	128	7	0	37	5
Totals	926	134	7	0	37	5

e) clinicians' perceptions of the system. In addition, a detailed log of usage and screen accesses is being kept in order to characterize system use. In an orthogonal design, some of the measures will be taken prior to and after implementation, on both the experimental unit and on a control unit similar to the experimental one. While impact on patient outcomes such as incidence or severity of pressure ulcers would be a logical evaluation parameter, the small sample size of patients and the low prevalence of actual pressure ulcers on this unit makes that infeasible in the present study.

DISCUSSION

The two AHCPR guidelines for prevention and treatment of pressure ulcers are more specific than many, and the treatment guideline particularly includes several algorithms. Still, we encountered several issues in trying to adapt these guidelines to be useful in providing decision support for specific clinical situations. These can be categorized as a) incongruity with local standards; b) insufficient specificity; and c) insufficient comprehensiveness. Tierney and colleagues reported similar issues in attempting to incorporate the AHCPR Heart Failure guidelines into decision support protocols for a clinical workstation[15].

Incongruity with Local Standards

Departmental policy calls for use of the North American Nursing Diagnosis Association (NANDA) nomenclature[16] in describing patient problems defined by nurses. The AHCPR guideline describes the phenomenon of "risk for pressure ulcer" for patients at risk, and categorizes actual pressure ulcers as Stages 1 through 4 as promulgated by the National Pressure Ulcer Advisory Panel. NANDA uses terms such as "Risk for Impaired Skin Integrity" and "Impaired Skin Integrity" and "Impaired Tissue Integrity" which have various degrees of congruity with the terms and definitions used in the guidelines. We resolved this by creating a hybrid list of diagnoses, not too foreign for nurses accustomed to the NANDA terms, but consistent with the definitions provided in the AHCPR materials.

The nutrition algorithm created some concern among our nursing and dietary clinicians, who felt that the algorithm reverted too quickly to tube feedings. We compromised by adding a step in the algorithm that called for more detailed assessment of oral nutrition problems and more forceful intervention to supplement oral feeding before resorting to tube feeding.

Insufficient Specificity

The decision points in the algorithms are at varying levels of specificity, which can pose problems for clinicians attempting to use them. For example, it is quite easy to answer the question as to whether the patient has multiple large, truncal stage III or IV ulcers. However, it may not be so easy to answer whether the ulcer is healing "properly." We resolved this by providing three choices to users at each decision point in an interactive algorithm: YES, NO and EXPLAIN. So, in the case of answering whether the ulcer is healing properly, the user can get an explanation (and a picture) of what a properly healing ulcer should look like. In other cases, we expanded the algorithm to include more specific steps, such as in dressing selection.

Insufficient Comprehensiveness

The AHCPR panel strongly advocates the use of standard risk assessment tools in determining risk, but the NANDA framework is broader, incorporating environmental factors and comorbidities. Patients who do not score significantly on the Braden or Norton scales may be assessed at risk because of combinations of risk factors such as age, steroid use, radiation, immunological problems, radiation therapy, etc., that are not on the risk scales. We resolved this by creating a hybrid assessment tool that included both the Braden and Norton scales as well as the environmental, psychological and medical factors that contribute to risk.

CONCLUSION

The impact of the experimental use of the system is currently being evaluated. If the system shows positive impact, the question of dissemination must obviously be addressed. Because a stand-alone system that accommodates only one clinical problem is not a viable long-term strategy, we expect to extract the knowledge access and decision support features of the system and make them available as clinician-

initiated tools for clinical decision support.

One attractive method for doing this is via the World Wide Web, where interactive applications are now feasible. The library of images could be made available to subscribing agencies for them to load on a local server, and called by the knowledge access/decision support protocols as needed. This arrangement would improve response time in the busy clinical environment. Issues of how to incorporate "local" standards are not clear, and would need to be addressed.

With nursing resources being increasingly constrained in today's health care environment, the time available for accessing knowledge to answer clinical questions is at a premium. We believe that indexing and rendering large textual guidelines into algorithmic format ready for patient-specific decision support is the most promising method of bringing consensually derived standards to bear on clinicians who must solve clinical problems in the context of particular patients.

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